

THESIS

A STUDY OF THE QUINCE

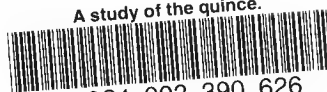
CHARLES J. TRIGGERSON

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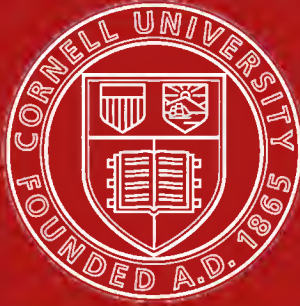
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A STUDY OF THE QUINCE.

Minor Thesis

Presented to

The Department of Horticulture

for

The Degree of

Doctor of Philosophy

by

Charles J. <sup>John</sup>Triggerson  
v=

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## A STUDY OF THE QUINCE.

This thesis is an outgrowth of a study of the quince both from the historical and practical standpoint. The data bearing on its culture, methods of harvesting, varieties, and commercial value, also the enemies and their control was obtained from field studies of several plantations in western New York. Hence it is largely an intensive study of the status of the quince industry of that section, and it is hoped that the information will be of practical value to those interested in this rather neglected, but none the less important fruit.

### HISTORICAL.

The once renowned quince known as "The Golden Apple of Greece", and so highly prized by the ancients has gradually become less known and more neglected than any other member of the pomal family. This may be due to the fact that other and more pleasing fruits have superseded it, or rather that the severe losses caused by its relentless enemies have led growers to abandon it.

None of our commercial fruits have a more remarkable history than the quince. By many authorities it is considered the "Golden Apple of Greece", that caused the dispute between Hera, Aphrodite, and Athena. It certainly was prized by the Greeks into whose fetes it entered both for decorative purposes and table use. According to



Professor Terrine De Lacouperie(I) it was introduced into Greece from Media about 700 B.C.,while reference is made to it in Chinese literature as early as 600 B.C. Pliny tells us that it was highly prized by the Latins both for edible and medicinal purposes.

Since no name for the quince is found in Sanskrit it is assumed that the fruit was unknown to the early Aryans.In Poland and Albania the names applied to it were not imported,but belong to the native language of the people;hence doubtless it was known ages ago as a fruit that had long since been established in these countries.It grows wild in the north of Persia,the region south of the Caucasus,the Crimea,along the banks of the Danube,in central China,Japan,and about Mount Taurus. De Candolle considers it possible that the quince was naturalized in eastern Europe long before the Trojan war, and has since been little modified by cultivation.

The common quince (*Cydonia vulgaris Pers.*)was introduced into England by the Romans during their occupation of that island,and in the middle ages was popular both there and on the continent for the manufacture of a preserve called cotignac.It doubtless found its way into this country along with other fruits brought

(I) Gardner's Chronicle Vol.<sup>III</sup><sub>I4</sub> 1893,p.273.



over by the early settlers. Several of our common varieties as we shall see later originated in America.

The Chinese quince (*Cydonia sinensis* Thoun) was imported into England in 1818, and probably soon after that date found its way into this country. It was fruited in Westchester county New York as early as 1854. *Cydonia Japonica* Pers. the Japanese variety, was brought to England by Sir John Banks in 1796, but did not appear in America until a much later date.

#### BOTANY.

The quince is a member of the tribe Rosales, family Rosaceae, subfamily Pomaceae. It is a small tree or shrub, lvs. petiolated, deciduous, serrate or entire; fls. white or red, solitary or in small clusters, rather large, petals five in number, stamens numerous; fr. aromatic, five celled pome, each cell containing many seeds. In Asia, in the region from Turkestan to Japan, there are four species namely *C. sinensis*, *C. Japonica*, *C. maulei*, and *C. vulgaris*. From the latter are derived all the commercial varieties found in western New York.

*C. vulgaris* Pres. (*Pyrus cydonia* Linn.) shrub or small tree, slender spineless branches; lvs. oval, oblong or rounded, slightly cordate, entire, villous-pubescent beneath, 2 - 4 in. in length; fls. white or light pink, 2 in. across;





fr. large, yellow, villous, pyriform to globular. Varieties *Lusitanica* Mill. a more vigorous grower, larger fruit, pyriform ribbed; *Maleformis* apple-shaped; *Pyriformis* pear-shaped.

*C. sinensis*, Thouin, (*Pyrus cathayensis* Hemsl.) shrub or tree; lvs. elliptic-ovate, acute at both ends, finely serrate, villous beneath when young, 2 - 3 in. long; fls. light pink, about 1 1/3 in. across; fr. dark yellow, oblong.

*C. Japonica* Pres. (*Pyrus Japonica* Thunbg. *Choenomeles Japonica* Lindl.) a shrub 3 - 6 feet in height, spiny branches; lvs. ovate to oblong, acute, serrate, glabrous above, 1 1/2 - 3 ins. long; fls. in clusters, 2 - 6 in. number, red, 1 1/2 - 2 ins. across; fr. globular or ovoid, yellowish green.

*C. Maulei* Nichols. (*Pyrus maulei* Mast. *Choenomeles alpina* Kochne) a low shrub, spiny branches; lvs. roundish, oval to obovate, obtuse or acute, coarsely serrate, glabrous, 1 - 2 in. long; fls. bright orange, scarlet, 1 - 1 1/2 in. across; fr. yellow, nearly globular.

#### THE INDUSTRY.

As an industry quince growing has been more extensive in New York State than in any part of the Union, the plantations ranging from half an acre to ten acres in size. Though owing to weak prices, and the serious attacks



of its enemies, it suffered a depression for a time, latterly renewed interest has been shown, and many plots have been set out. Until more attention is paid to the quality of the fruit, better means of marketing adopted, and the public more widely educated to its remarkable value, the demand will be limited, and quince growing will not be as important as our other orchard industries. However, owing to the comparative ease with which cultural methods can be practised, and the crop harvested, also considering the regular bearing habits of the tree, and the lasting quality of the fruit, the crop has much in its favor. Further, as we shall see later in this discussion, the average income per acre obtained from a well-cared-for plantation compares very favorably with that received from other fruits, and hence renders it a valuable investment for the practical grower.

#### SOILS.

The quince like some other fruits has its decided preference for soils. While some varieties do well on lighter soils, and others bear liberally when grown on heavy clay, in general it is never so productive as when grown on the heavier loams. From what could be obtained from observation, and conversation with the various growers, it is evident that the quince thrives better, and produces



better crops when grown in the heavier loams of composite character - as for example the Dunkirk loam type. The soil should be such that when properly drained it would retain sufficient moisture, and at the same time be rendered friable by proper tillage. Such treatment will ensure good aeration, and greatly assist in making plant food obtainable. Trees planted on such loams will not come into bearing as early as those on lighter soils, but they will last longer, and eventually produce larger harvests.

This however must not lead us to conclude that the quince will not flourish on the lighter sandy soils, nor on the heavier and more compact clays. With the former greater effort will be needed to conserve sufficient moisture, and more humus will be required. The trees will fruit earlier, but the period of their productiveness will be shortened. The compact clay soils will demand both good drainage and thorough cultivation, while the cover-crops used should have a deep spreading root system, which will aid in breaking the soil thus broadening the foraging area of the trees. Upon such soil the pear quince gives good results.

#### PROPOGATION.

The propagation of the quince differs according to the localities and soils in which it is grown. In



western New York where heavy loams abound, budding is generally practised. The Quince is the stock used, and is the same as that employed for the dwarfing of the pear. The stocks are imported from France when two or three years old, and have either been grown from seed or obtained from mound layering. They are planted in the nursery row, budded in August, and sold when two or three years of age from the time of budding. Some growers graft the scions on bits of apple roots. This is usually done in the winter. The union is sufficient to nurse the scion for two or three years, but should be removed since suckers are apt to spring from the stock and interfere with the growth of the quince.

#### PLANTING & PRUNING.

In most of the older plantations the trees were set from ten to twelve feet apart. This has proven to be too close, since, owing to the character of the trees, clean tillage has been hindered, spraying interfered with, and rather heavy pruning necessitated. As a result some growers are feeling it necessary to cut out alternate rows diagonally. At present the prevailing opinion is that trees should be set about sixteen feet apart, thus giving plenty of room for practising proper cultural methods, and rendering harvesting easier.





In earlier times little attention was paid to the form of the tree, its bush-like character not being interfered with. For some time now the practise has been to transform the bush into a tree. The head should be started from sixteen to twenty inches from the ground, and the top trained to the shape of an inverted cone. The mature tree in the nursery row is conspicuous for its symmetrical shape, and the absence of the bush-like appearance once so characteristic of the quince. The growth in the young tree often exceeds thirty inches, of which generally one fourth is removed by pruning. With the mature tree the growth is not so great, since the bearing habit has become established. If however such trees continue to make heavy growth of from twenty to thirty inches, they must be pruned back in the winter, though as pointed out in C.U. bulletin # 80, under proper soil management such treatment would not be necessary. The practise of severe heading-in is not now in vogue with the growers. As already noted some heading-in is necessary with young trees, but in a bearing plantation such a practise means the thinning of the fruit. It must be remembered that with the quince the fruit is terminal, hence the shortening of the annual growth cuts off the "terminal bloom". As a result the fruit will be formed the following year on side shoots. It is possible by providing proper rations



for the trees in conjunction with the treatment of the soil to promote fruitfulness rather than vegetative growth, thereby securing the desired result in a more satisfactory way. These however are questions which each must work out for himself after having become thoroughly acquainted with the soil in his plantation.

In general, attention should be called to the following axioms in pruning:-

- A. All branches should be cut off close to the parent stem.
- B. All wounds exceeding an inch in diameter should be painted with oil paint, the paint being renewed each year until such time as the wound is healed.
- C. When branches infected with blight have been removed, first treat the wound with corrosive sublimate, then paint with creasote paint.
- D. Pruning should be practised yearly rather than by general occasional thinning.
- E. All water sprouts and suckers should be removed as soon as noticed.

#### CULTIVATION.

The evolution of quince culture is a short but interesting story. It is not a long step from the day of



the poorly located and neglected plots, to the present well-cared-for and thriving plantation. Growers have felt that the methods which have made the apple, pear and peach industries can be applied to the quince with profit. Some find that during the early growth of the trees a root crop can be planted between the rows, since it necessitates the application of fertilizers, and the cultivation of the soil, thus keeping it friable, and rendering the plant food more easily obtainable to the young tree. As a general practise this would be unwise, for it would eventually rob the trees of proper nourishment, thus hindering their development. The energy of the soil should be conserved primarily for the use of the trees.

The following tabulations are taken from the data obtained during the survey of the quince plantations of western New York in the fall of 1909.



## II.

Table I. Fertilizers, Cover Crops, Tillage, and Spraying.

No. of acres of in in orchds. farms. quinces.			Fertilizers.	Tillage.	Spraying.
I.	52.	3.	Barnyard manure.	Clean.	
I.	52.	3.	{Barnyard manure Commercial fert. Cover crops.	Clean	I. Dormant; 3 Bordeaux & Arsenate of lead.
I.	13.5	1 1/2	{Barnyard manure Cover Crops.	Clean	I. Dormant: 3 Bordeaux & Arsenate of Lead
I.	100.	5.	Barnyard manure	Clean	3. Bordeaux
I.		3.	{Barnyard manure Salt	Clean	3. Bordeaux & Arsenate of lead.
I.	100.	2.	{Barnyard manure Salt	Clean	I. Dormant; 3 Bordeaux & Arsenate of lead.
I.	107	3 1/2.	Barnyard manure	Sod.	I. Bordeaux
I.	23.	1/2	Barnyard manure	Clean	
I.	125.	4.	{Barnyard manure Cover Crops	Clean	3. Bordeaux
I.		1/4	{Barnyard manure Commercial fert.	Clean	3. Bordeaux
I.	25	4.	Barnyard manure	Clean	3. Bordeaux
I.	50.	1/2		Sod.	I. Bordeaux
I.	100.	10.	{Barnyard manure Cover Crops.	part sod " clean.	3. Bordeaux





From the foregoing table it will be seen that no fertilizers are widely used. Of the orchards visited, all but one received a liberal dressing of barnyard manure at least every other year, and in some instances yearly. About 50% used green manure in the form of cover crops, while 25% added a commercial fertilizer. The thriving condition of the trees, and the substantial returns of the past few years testify to the value of the practise. Since not sufficient data on the matter of food as applied to the quince is at present available, one cannot absolutely state the relative values of the various foods supplied. It seems to the writer that a balanced ration consisting of combinations of fertilizers and cover-crops, with a rotation of the same over a definite period, is the ideal method of treating a plantation. By such a careful combination of fertilizers with nitrogenous and non-nitrogenous cover-crops so as to obtain a proper balance of the various elements required by the tree to promote growth, retain healthy foliage, and give quality and color to the fruit, many of the severe measures resorted to would be abandoned, the fruit improved, and the returns augmented.

With those plantations situated on steep hill sides, where only sod culture is practicable, clean tillage is the rule. Of all the fruits perhaps none make a stronger demand for such treatment than the quince. Susceptible as it is to the ~~attacks of both~~ borers and fungi, all methods of sod and mulch



culture, which greatly aid these pests should be avoided. Since the quince is a shallow rooting tree, tillage must be conducted with care. Very shallow ploughing or cultivating with a harrow will sufficiently break the ground. Cultivation should be continued at intervals until approximately early July. This date will of course be governed by the character of the season, the desire to hasten or retard the maturing of the fruit, and the effort to mature the wood thus protecting it against winter killing. The ground may be left in a fine mulched state or a cover-crop sown.

The value of a cover-crop is too well known to demand attention here, a thorough discussion of the subject will be found in the Experiment Station bulletin of Cornell University # 198. Since the trees are headed low, pasturing with hogs and sheep is not favored. Some of the growers have tried this plan, but the results have not been satisfactory.

#### HARVESTING & MARKETING.

Under normal conditions the trees begin to bear when five or six years old, and reach their full capacity when ten or twelve years of age. Not a few well-cared-for plantations from thirty five to forty years of age are still producing good crops. The time of picking usually extends from the last week of September to the



third week of October. This year, good bearing trees in large plots produced 1 1/2 bushels each, while those widely separated, and in smaller plantations yielded two bushels per tree. The quince when ripe is an attractive fruit, and if well cared for, the fuzz removed so as to show the rich color, neatly packed, it would hold a foremost place among the culinary fruits. At present it is increasing in favor.

The method of packing, and the package used depends on the market for which it is destined. Those who supply local trade use half bushel baskets, while those who ship to more distant markets use either the small or regular shaped barrel. In the present system of handling the crop some points may be considered. Since the fruit bruises somewhat easily, and each bruise becomes a dark brown spot, which mars the otherwise attractive fruit, great care should be shown not only in the picking, but also in the subsequent handling of it on the packing table, and when passing to the barrel. Furthermore, more careful discrimination might be shown in grading. A larger number of seconds would doubtless result, but the improved and more uniform quality of the firsts would bring a much higher price, thereby more than counterbalancing the difference made in the increase of seconds. One lucrative market is passed over by many growers, namely the selecting, cleansing,



and careful packing in attractive packages of perfect specimens which will readily find sale at advanced prices in the various markets. It is true that the quince is not a dessert fruit, nevertheless the price is determined in a measure by the attractive way it is packed. As Dean Bailey pointed out in C.U.Bul. # 80 "It is noticeable that the placing of each individual fruit by hand in small packages brings as good returns as it does in peaches and other dessert fruit.





## VARIETIES.

A. Classification:-In this we have followed Waugh's artificial classification as given in F.A. Waugh's Systematic Pomology.

		<u>Form.</u>	<u>COLOR.</u>	<u>Variety.</u>
Early.		Round.		
SEASON AUTUMN.	Medium	Pyriform.	abrupt. large	rich yellow lemon yellow
				Rea. Fuller.
		Round.	large & regular.	golden yellow
	Medium			Orange.
			large & irregular.	russetted
				Apple.
Late.	Medium	Pyriform	short	golden yellow
				Meech.
		Round.		
Late.	Medium	Pyriform.	large	greenish yellow
				Champion.
Late.	Medium		long	dull yellow
				Pear.



## B. Descriptions.-

Few varieties of the quince are grown in western New York, about five being of commercial importance namely - the Orange, Rea, Champion, Pear, Meech, and Apple variety of the Orange.

**Orange.-** The Orange is of European origin, and being generally reliable and productive, is most widely grown. The tree is vigorous and spreading, lvs. oval to elliptical, margin entire, color dark green above, lighter on the underside; fr. large regular roundish, neck small, stem depression shallow, basin deep, flaring, color golden yellow, surface slightly covered with fuscous down, flesh firm, season medium, keeping qualities good.

**Rea.-** This variety is of American origin, being raised as a seedling about forty five years ago by Joseph Rea Coxsackie N.Y.

The tree is spreading, vigorous grower, but somewhat shorter than the Orange; lvs. large ovate, entire, dark green above, lighter on the under side; fr. abruptly pyriform, large, covered with a gray fuscous down, stem end with medium depression furrowed at top, basin medium, somewhat constricted, color rich yellow, flesh firm, granular, season early autumn, keeping quality good, but not equal to the Orange.

**Champion.-** This is also of American origin. The tree is a tall, upright, vigorous grower, lvs. ovate, margin entire, yellowish green. fr. large, pyriform, covered with yellowish fuscous down, furrowed



at the stem end;basin deep,calyx reflexed,color greenish yellow,flesh firm,season late autumn,keeping qualities good, but it does not always ripen well.

Pear.- This variety though not so excellent as those already described is widely grown.The tree is somewhat smaller than the Orange,but spreading,lvs.ovate,more pointed at the apex, and smaller than those of the other varieties,edge entire, color medium green;fr.long pyriform,covered with gray fuscous down which adheresclosely,body roundish,neck about one third the length of the body,stem depression deep,furrowed at top, basin medium,flesh firm,granular,season late autumn.

Meech's Prolific.-This is also an American variety,having originated in Connecticut,and was described by W.W.Meech in 1883.The tree is spreading and vigorous;lvs.ovate,margin entire;fr. short pyriform,furrowed at top,covered with fuzz, basin medium,color golden yellow;season autumn.The growers feel that this variety has not sustained its reputation.

Apple(variety of the Orange) The tree and foliage are smaller than the orange;fr.small,flattened at both ends,roundish, somewhat irregular,stem depression very shallow,basin medium color golden yellow to russetted,flesh firm,season autumn, keeping quality good.



Fuller:-This variety is of American origin put out by J. J. Luddock of New Jersey. The tree is spreading, open, tall; lvs. ellipsoidal, edge entire, color bronze green; fr. large pyriform. neck small and short, surface smooth and regular, stem depression shallow, basin deep and flaring, color lemon yellow, flesh tender, season early autumn, keeping qualities fair; a good variety for fancy packing.

C. The relative Economic values of the various Varieties.

The following table provided by the Department of Home Economics of Cornell University gives the results of experiments performed to determine the relative economic value of the various varieties.







II. Results obtained from					
Variety.	Form	Weight	Weight		Amount
	Manufactured.	Raw material.	pared.	Loss.	water used.
Pear	Canned	1116 Gr.	789Gr.	.293	3cc
"	Baked	597 Gr.	297Gr	.502	1 1/2cc (juice)
"	Jelly	761 Gr.	678 Gr.	.109	1cc.
Orange.	Canned	1279 Gr.	1004Gr.	.734	6cc
"	Baked	681 Gr.	540Gr.	.792	1 1/2cc. (juice)
"	Jelley	1164 Gr.	1062Gr.	.912	5 3/4cc
Rea.	Canned	1173 Gr.	805Gr.	.686	2 cc.
"	Baked	873 Gr.	601Gr.	.686	1 1/2 cc.
Champion	Canned	627 Gr	503Gr.	.802	3 cc.
"	Baked	633 Gr.	375Gr.	.703	1 1/2 cc. (juice)
"	Jelly	868 Gr.	786Gr.	.905	4 cc.
Apple	Canned	1025 Gr	745Gr.	.873	3 cc.
"	Baked	1054 Gr.	795Gr.	.754	1 1/2 cc (juice)
"	jelly	999 Gr.	969Gr.	.997	3 cc.

Cooking test.

Am't Sugar used.	Am't Fruit produced.	By-products produced.	Loss From By-product.	Remarks.
3 cc.	2 pt.	Jars.-----	-----	The fuzz is hard to remove.
I I/2c	I " "	-----	-----	
I cc.	3 I/4cc.	Marmalade 3cc.	pulp I I/4 cc.	
4 cc.	4 pt.	jars.-----	-----	
I I/2c	I " "	-----	-----	
5 /54c	4 I/2 cc	Marmalade 4 cc.	pulp I/4c	
3 cc.	2 pt.	Jars -----	-----	
I I/2c	2 " "	-----	-----	Champion cooks sloper than the other varieties.
2cc	I pt.	jar. -----	-----	
I I/2c	1 " "	-----	-----	
4cc.	4cc	Marmalade 2 I/2 cc.	pulp I/2 cc.	
2 cc.	2 pt.	jars-----	-----	
I I/2c	2 " "	I glass jelley -----	-----	
2 I/2c	5 glasses	Marmalade I 3/4 pts.	pulp I/2cc.	



From a study of the foregoing table, and a test of all the various products made, it was found that the Orange presented a very attractive fruit, being coherent, fine in texture, smooth and melting, and of a rich orange-yellow color. The cost of production was slightly above the average, and the loss from 7/10 - 9/10 of a percent. Rea's Marmouth gave a light yellow fruit of firm consistency, close adhering, but somewhat coarser in texture, and more aciduous than the Orange. The cost of production was less than with the former, while the loss was from 6/10 - 8/10 of a percent. The Champion, though presenting an attractive fruit of light yellow color, firm in texture, was granular, less attractive, and more costly in production than the others. The Pear variety gave in general the poorest results, being exceedingly acid, coarse in texture and costly to put up. The Apple quince was of excellent flavor, but the flesh was loose, and showed a tendency to break up readily. It may be said that the Orange, Rea, and Champion in general appearance were equal, but considered in all respects rank in the order named.



## YIELD &amp; INCOME.

II. Average yield and income per acre 1907 - 1909.					
No. of Farms.	total acres.	acres in quinces	average yield per acre bbls.	average price per bbl.	average income per acre.
I.	52.	3 1/2	74 4/9	\$3.91 2/3	\$262.41
I.	13.5	1/2	48	3.91 2/3	188.00
I.	100	8	59 3/8	3.50	209.37
I.		3	66 2/3	3.91 2/3	261.11
I.	107	3 1/2	64 6/7	2.75	178.35
I.	125	4	50	3.62 1/2	181.25
I.	100	1/4	36	3.75	135.00
I.	25	4	38 7/12	3.28 1/3	118.85
I.	100	2	53	3.75	189.75

That the quince industry is a paying investment can be readily seen from a study of the figures presented in the preceeding table. The yields and prices for each of the three successive years were obtained in every possible instance, in order that the possibilities in quince growing might be fairly shown. The variation in the average income and yields for the three years is largely traceable to methods of cultivation, and varietal differences.





## ENEMIES.

Unfortunately the quince falls a ready victim to several enemies namely - Fire-blight, Leaf-blight and Fruit-spot. Rust, The curculio, Codling moth, Borer, and San Jose scale. These may be grouped into Plant Parasites and Insect Pests.

## PLANT PARASITES.

## Fire-Blight:-

This is a bacterial disease, and is largely disseminated by aphids. It is particularly destructive in the young plantations where growth is abundant. It attacks the young succulent shoots, and destroying these proceeds to take possession of the entire tree. Sometimes within one season it will sweep over the entire plot. Among the older trees it frequently attacks the twigs, blossoms, and young fruit. Under favorable conditions it may pass from the twig to the parent stem and limb, leaving in its track the characteristic canker, with the dead, dried, withered leaves, and mummified fruit clinging to the branches.

The distinguishing characters are- the canker with raised margin, smooth unchecked sunken area of brownish color. This is usually active but one season, except in the case of hold-over-cankers where the disease



is carried over the winter in a dormant state, but resumes activity in the early spring. The twig and blossom blight is readily noticed by the presence of the canker on the twigs, also the withered, drooping leaves and blossoms. The disease spreads rapidly in cloudy, humid weather, at which time the active cankers exude milky drops that teem with bacteria.

The only method of treatment is to cut out the infected parts as soon as the disease appears, being careful to sever the branch at least three inches below the base of the canker. The wound should be thoroughly disinfected with corrosive sublimate, and painted with creosote paint. All cuttings, dead leaves, and mummified fruit should be burned. Such treatment will eradicate the disease, and by careful watching it can be kept under control. For a comprehensive treatment of this disease see Cornell Bulletin #272.

#### Leaf-Blight & Fruit-Spot:-

The most serious and wide spread fungus disease is known as Leaf-blight and Fruit-spot, and is caused by the fungus *Entomosporium maculatum*. This defoliates the trees early, and causes black spots on the fruit. The first appearance of the disease is a small circular discolored area on the leaf, which becomes dull red with darker margins. Finally the leaves become yellow, and begin to



fall in August and early September, the trees being completely defoliated before the fruit is fully developed. Such a loss of foliage deprives the fruit of proper nourishment, and as a result it does not mature. Further, this is injurious to the tree, since it prevents the storing of the needed food supply. Under normal conditions the foliage should persist until after harvest. The disease is not confined to the leaf, but attacks the fruit as well. Here the spot is at first red, later becoming brown and sunken. Frequently there is a drying of the outer layer, which extends for some distance, and as a result cracking ensues. Probably the disease is found in all orchards, but it is most serious in sod or neglected plantations. Fortunately it can be controlled by spraying with Bordeaux of the strength 5-5-50. Most growers make three applications of this spray at intervals of from ten to fourteen days each.

#### Rust:-

This disease is caused by the fungus *Gymnosporangium nidus-avis*, and as a rule is present in most orchards, but is not troublesome. It may attack portions or spread over the entire fruit, the infected area becoming dry, hard, black, and sunken. In the fruiting stage it appears as an orange-like fringe in the long tube-like structures of which the spores are produced. Sometimes it



attacks the twigs giving rise to knotty growths. This fungus, like other rusts, does not pass its life cycle on one host. The spores from the fruiting body on the quince will not produce the rust again on that fruit, but are carried by the wind to the cedar or juniper, where they give rise to the witches-broom on that host. From this in the spring time the spores are produced which attack the quince. The rust is rarely serious, and can be controlled by the spray used for the Leaf-spot.

#### INSECT PESTS.

The Curculio (*Conotrachelus crataegi*):—Of the insects that attack the quince this is the most important. The beetle is closely allied to the one that attacks the peach and the plum. It punctures the fruit causing it to be rough and knotty. The general method of treating this pest has been to jar the trees, and capture the insects on a sheet spread for the purpose. This method has been costly, both in the number of men required for the operation, and the rough treatment the trees sometimes received. The general trend at present is to use arsenate of lead, adding this to the Bordeaux mixture, and applying thoroughly to the fruit. In general it has proven satisfactory holding the enemy in check. During the past summer the Department





conducted experiments to test the value of arsenate of lead in controlling this pest. The insecticide was used alone, and in conjunction with bordeaux. Both plots were sprayed four times, namely on June 14th., and 35th.; July 2nd., and 12th. In all instances the trees were thoroughly covered, but particular attention was paid to the fruit. The spray was driven well into the calyx cup, and the fruit covered with a good film. The plots were visited several times during the season, and close observations made. When the fruit was harvested, and examined it was found to be perfectly clean and free from the effects of curculio. In view of these results, the experience of growers, and the fact that the Horticulturists of other States find this method successful, it may be recommended as an effective means of holding the enemy in check. The amount of arsenate of lead used was two pounds in bordeaux 5-5-50.

#### The Codling-Moth (*Carpocapsa pomonella*)

This is the same pest which so many orchardists find troublesome to the apple. With the quince its attacks are not so serious. The best method of control is by applying arsenate of lead in conjunction with bordeaux, being careful to drive the spray well into the calyx-cup.



The Borer (*Superda candida*).

This insect which seems to have a preference for the quince should be dug out. The crowns and trunks of the trees should be examined both spring and fall. With a wire penetrate the mine of the borer, and destroy the larva.

*Comst.*

The San Jose Scale (*Aspidiotus perniciosus*)

This insect though not so widely spread as other pests, is when once established in a plantation the most to be dreaded. Fortunately the character of the quince tree makes the fight easier. Here the grower does not have to contend with a high tree, or overly bushy top, hence some of the great hinderances to spraying are overcome. Considering the low and easily accessible character of the tree, even with fairly favorable conditions spraying should not be a difficult task. The general method of combating this insect is with whale-oil soap, or kerosene emulsion. The plantations visited during the survey appeared free from this pest.

#### THE VALUE OF SPRAYING.

From Table I it will be seen that the growers give close attention to the practise of spraying, 25% spray four times, the first being a dormant spray; 50% make three applications while 25% spray once. The relation of the



yields and income to this practise of orchard management cannot be readily made from a comparison of plantations. Considering the numerous enemies which infest the quince, it is evident that no harvest of any value would be secured were it not for a thorough protection of the fruit and trees. Considering the same varieties, it may be said, that the plantations which have been thoroughly sprayed at the proper time have shown a decided increase in returns over those not so favorably treated.



## CONCLUSIONS.

From the foregoing study the following brief conclusions may be drawn.

- A. The quince is a native of Greece, and grows wild from Turk~~h~~estan to Japan. It was introduced into England by the Romans, and was brought to this country by the early settlers.
- B. As an industry quince growing is more important in Western New York than in any part of the Union, and the average income per acre compares favorably with that received from other fruits.
- C. The heavy loams, as for example the Dunkirk loam type, are best adapted to this fruit. Good drainage is essential for the best results in quince culture.
- D. Propagation is chiefly by budding, though hard-wood cuttings, and scions grafted on bits of apple roots may be employed.
- E. Trees should be set sixteen feet apart, the head started at from 15 - 20 inches, and trimmed to an inverted cone.
- F. Clean culture is most important in quince plantations, and owing to the shallow-rooting habit of the tree shallow tillage should be practised.

In fertilizing, a balanced ration of barnyard manure, covercrops, and commercial fertilizers combined





with nitrogenous or nonnitrogenous cover crops will provide the necessary plant food, and render best results.

G. The trees begin to fruit when five or six years old, and reach full bearing capacity when ten or twelve years of age. Harvesting extends from the last week in september to the last of october. Too much care cannot be shown in the handling, selecting, cleaning, and packing of the fruit, as return depends in a large measure on the attractiveness of the product.

H. The varieties common in Western New York are the Orange, Rea, Champion, Meech, Pear, and Apple, the most widely cultivated being the Orange, Rea, and Champion.

I. The results of the experiments conducted by the Home Economics Department show that the Orange, Rea and Champion rank in commercial importance in the order named.

J. That the quince industry may be a paying investment is readily seen from a study of Table II, which shows the average yield and income of the plantations visited for a period of three years.

K. The chief enemies of the quince are as follows:-

Bacterial	Fire-blight
Fungi	Leaf blight & fruit spot; Rust.
Insects	Curculio, Codlin moth, Borer, & San Jose. scale.



The methods of combating these various pests will be found in pages nineteen to twenty-four.

In conclusion,I wish to thank Professor Craig for the assaintance,and criticism so freely given.Also I desire to thank the Department of Home Economics for the experiments performed by them,which made the completion of this problem possible.



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Plate I.

- Figure 1 Pear quince, long pyriform.
- Figure 2 Champion quince, large pyriform.
- Figure 3 Fuller quince, large pyriform.
- Figure 4 Rea quince, abrupt pyriform.
- Figure 5 Orange quince, large, regular roundish.
- Figure 6 Apple quince, irregular roundish.



